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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The effect of regional changes in anthropogenic aerosols on rainfall of the East Asian Summer Monsoon" *by* L. Guo et al.

Anonymous Referee #1

Received and published: 30 October 2012

Reviewer comments: MS No.: acp-2012-628: "The effect of regional changes in anthropogenic aerosols on rainfall"

General comments:

Guo et al., 2012 discuss about the role of anthropogenic aerosols on regional rainfall over Asia using an atmospheric general circulation model. The focus is on understanding the influence of sulfate and BC aerosols, separately, on the precipitation over East Asia. The manuscript concludes that cooler surface temperature due to enhanced sulfate aerosols decreased precipitation via changing EASM circulation during September. The paper is generally well written and the effects of anthropogenic aerosols on precipitation during East Asian summer monsoon season are quite interesting. There are certain points about the parameterization for stratiform and convective clouds and

precipitation, which are not clear in the manuscript. These points should be made clearly to help the reader to put the paper in context with the existing literature (e.g. papers suggesting anthropogenic aerosols may either increase or decrease precipitation). The paper should be published after addressing the following questions.

Specific comments:

1) The manuscript does not provide detail about how the precipitation (stratiform and convective) is parameterized in the model. This information would be useful to the reader in the interpretation of the results.

2) The manuscript does not provide information about the optical properties assigned to sulfate and BC in the model. The authors should describe the treatment of refractive index and size distribution (Mie calculation) used for sulfate and BC in both experiments. Also need to mention about the single scattering albedo used in the radiative transfer calculations. It could be useful if the authors add one discussion about the how the sulfate and BC AOD different in both experiments. Are there uncertainties that might influence the results?

3) The model-simulated precipitation (JJA) patterns look too different compared to the GPCP patterns (Figure 2), especially over the Indian region. There is a possibility that the model could appear to give a precipitation response for the wrong reasons. Could the authors address this more carefully?

4) The manuscript concludes that the precipitation is reduced by the increased anthropogenic aerosol emissions during September- would this conclusion change if the all anthropogenic aerosols (BC, OC and sulfate) together considered?

5) There is no information about the data sets (e.g. GPCP, ERA-40) used in the study. The authors need to add one section describing about the datasets used to evaluate the model-simulated parameters.

6) Also, no information (figure) is provided about the vertical profiles of the aerosols

(Page 23017, lines 11-16) - can the authors address this and how we may interpret these results relative to the 'Elevated Heat Pump' theory.

7) What is the influence of transported aerosols to the study region? Since Rest of the world emissions are kept constant at the 2000 level in all experiments (section 2.2).

8) The authors should also address more specifically in the conclusion section about the improvements they have achieved from the present study in context with the existing literature.

Technical comments:

1) In abstract section Page 23008, Line 12: Quantify the precipitation change.

2) Page 23008, Lines 12-14: Why precipitation is decreased significantly in September? Whether both convective and stratiform precipitation is decreased? How the aerosol-radiative forcing different in September? The authors need to quantify how the surface cooling is different in September compared to other months?

3) Page 23010, Lines 3-5: What is meant by "some aerosols"? Is it BC? Rephrase the sentence.

4) Page 23010, Lines 16-19: The sentence is not correct. All the cited papers showed enhanced rainfall mainly in the early summer monsoon season.

5) Page 23011, Lines 5-7: The mechanism is not clear. Is it same as EHP hypothesis?

6) Page 23012, Lines 16-17: What is meant by "biomass burning material" species?

7) Page 23012, Line 18: What about the contribution from organic carbon? Could you add a reference to the sentence?

8) Page 23016, Line 15-18: How the water-uptake by sulfate aerosols is parameterized? Is dry sulfate column burden simulated? What is the seasonality in SO2 emissions used in the model simulations?

9) Page 23013, Lines 7-10: The oxidant fields for sulfate chemistry is prescribed or calculated? Could the authors specify the oxidant fields more clearly?

10) Page 23015, Lines 14-25: Could the authors be more quantitative in their presentation. I would like to see a more rigorous statistical analysis related to evaluation of the model, perhaps a consideration of the mean bias and correlation.

11) In Section 2.3, mentions the evaluation of model-simulated JJA seasonal rainfall? Could the authors add one figure in SI about the evaluation of monthly-mean rainfall for the period from April to September?

12) In Figure 2, the authors compared the rainfall for two different periods. Could the authors plot this for the same period (1983-2000) and same resolution? This would be useful for the reader to interpret the results.

13) Page 23016, lines 15-18: Whether dry aerosol burden is mentioned? What type of seasonality used in fossil fuel SO2 emissions?

14) Page 23016, lines 21-28: Could the authors add the cloud droplet number concentration figure into Figure 3? This information could be useful for the reader to understand the aerosol indirect effects.

15) Page 23017, Lines 5-7: The authors used no seasonality for BC emissions in the simulations. BC emissions from biomass burning emissions (forest and crop residue) exhibit significant seasonal variations. Would the conclusion from BC aerosols change if the emissions seasonality is included?

16) Page 23017, lines 11-13: The authors need to evaluate the vertical distribution of BC and sulfate aerosols.

17) Page 23018, lines 12-13: Could the authors add a figure reference to this statement.

18) Page 23018, Line 25-28: The definition of radiative effect should be moved to the

methodology section. Is the radiative effect simulated in the SW spectrum?

19) Page 23020, lines 5-9: Could the authors add some observational precipitation trends to corroborate the findings (Figure 7c)?

20) Page 23022, lines 1-8: Could the authors specify whether the forcing values from clear-sky or all-sky conditions. Also add some discussion about the cloudy-sky forcing to support the indirect radiative effect findings.

21) The conclusion section uses the terms 'slightly compensated, and small decrease'. Could the authors be more quantitative in their presentation?

22) Check the Figure 7 caption and correct it.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23007, 2012.